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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/707,009	11/13/2003	Toshiharu Furukawa	FIS920030300	1008

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EXAMINER

ROSASCO, STEPHEN D

ART UNIT	PAPER NUMBER
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1756

DATE MAILED: 07/07/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/707,009

Applicant(s)

FURUKAWA ET AL.

Examiner

Stephen Rosasco

Art Unit

1756

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 07 January 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-20 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 13 November 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 1/7/04.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

Detailed Action

The disclosure is objected to because of the following informalities: all the dependent claims read "method in" which should be changed to --method of-. The use of "in" does not further limit the claim as an addition but merely refers to what is in the claim.

Claim 4, line 2, "controlled to the adjust"; page 8, 4th line from bottom, "formation silicon".

Appropriate correction is required.

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-20 are rejected under 35 U.S.C. 102(b) as being anticipated by Tsuchiya et al. (5,536,603) or Brunner et al (5,470,681) or Lee (5,900,337).

The claimed invention is directed to a method of forming a phase shift mask comprising: patterning a non-transparent film on a transparent substrate to expose areas of said transparent substrate; forming a mask on said non-transparent film to protect selected areas of said transparent substrate; forming a phase shift oxide on exposed areas of said transparent substrate; and removing said mask.

wherein said process of forming said phase shift oxide comprises placing said transparent substrate and said non-transparent film within a deposition bath.

And wherein said process of forming said phase shift oxide is controlled to form a desired thickness of said phase shift oxide.

wherein said process of forming said phase shift oxide is controlled to adjust the optical properties of said phase shift oxide;

wherein said process of forming said mask forms openings in said mask above openings within said non-transparent film to allow selected areas of transparent substrate where said phase shift oxide is to be formed to be exposed;

And wherein said non-transparent film comprises one of chrome, tungsten, molybdenum, molybdenum silicide, and a chrome film.

Tsuchiya et al. teach a method of fabricating a phase shift mask, comprising the steps of: forming a light shielding film pattern on a transmitting substrate; forming a first photoresist pattern on part of an exposed surface of said transmitting substrate; forming a first phase shifter on an exposed surface of said transmitting substrate by liquid phase deposition so that a reaction liquid flows on said transmitting substrate at a flow rate of at least 6 mm/sec;

removing said first photoresist pattern;

forming a second photoresist pattern on a surface other than the exposed surface of said transmitting substrate, said exposed surface being adjacent to said first shifter;

forming a second phase shifter, having a different thickness from that of the first phase shifter, on the exposed surface of said transmitting substrate by liquid phase deposition so that a reaction liquid flows on said transmitting substrate at a flow rate of at least 6 mm/sec;

annealing said first phase shifter and said second phase shifter and controlling at least one of the thicknesses of said first phase shifter and second phase shifter and a refractive index of said second phase shifter; and removing said second photoresist pattern.

Brunner et al. teach a method of forming a lithographic exposure mask including the steps of applying a pattern of material having openings therein to a substrate which is transparent to at least one form of lithographic exposure radiation, and selectively depositing silica in said openings to a first thickness from a supersaturated solution of silica in hydrofluorosilicic acid.

And including the further steps of applying a further pattern of material at least in selected openings in said pattern, and further selectively depositing silica in remaining ones of said openings to a second thickness from a supersaturated solution of silica in hydrofluorosilicic acid.

And including the further step of applying an opaque material to said substrate prior to said applying step.

Lee teaches a method for fabricating a phase shift mask comprising the steps of: providing a light transmissive substrate;

forming an etch stopper layer, a light shielding layer and an oxidation preventing layer on the light transmissive substrate; selectively removing the oxidation preventing layer and the light shielding layer to form a plurality of first transmissive regions; partially oxidizing portions of the light shielding layer at sides of each of the first transmissive regions to form first phase shift regions, wherein the first transmissive regions and the first phase shift regions comprise a plurality of first light transmissive patterns;

selectively removing the oxidation preventing layer and the light shielding layer at locations between the first light transmissive patterns to form a plurality of light transmissive holes;

depositing a photoresist on an entire surface of the substrate including the light transmissive holes;

selectively removing the photoresist from a central part of each of the light transmissive holes to form photoresist holes;

forming a second phase shift region having a predetermined depth in each of the photoresist holes; and

removing the photoresist, wherein the second phase shift regions and transmissive regions at edges of the second phase shift regions form a plurality of second light transmissive patterns.

And wherein the step of forming a second phase shift region having a predetermined depth in each of the photoresist holes includes the steps of: dissolving an oxide powder in hydrosilicofluoric acid water solution;

submerging the light transmissive substrate having the photoresist holes formed thereon into the hydrosilicofluoric acid water solution; and

growing an oxide on the etch stopper layer to a predetermined thickness as the second phase shift region.

And wherein the step of forming a second phase shift region having a predetermined depth in each of the photoresist holes includes the steps of: sputtering an oxide in the photoresist holes; and conducting a chemical mechanical polishing of the oxide to form the second phase shift region.

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The cited art all teach the claimed invention including forming a phase shift oxide on exposed areas of a transparent substrate comprises placing said transparent substrate within a deposition bath. And controlling the growth of the oxide to give the desired optical properties to the phase shift layer, which is based on the thickness of the layer.

Conclusion

Any inquiry concerning this communication or earlier communications from the Examiner should be directed to Stephen Rosasco whose telephone number is (571) 272-1389. The Examiner can normally be reached Monday-Friday, from 8:00 AM to 4:30 PM. The Examiner's supervisor, Mark Huff, can be reached on (571) 272-1385. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

A handwritten signature in black ink, appearing to read 'S. Rosasco', with a stylized, elongated 'S' and 'R'.

S. Rosasco
Primary Examiner
Art Unit 1756

S. Rosasco
06/29/05